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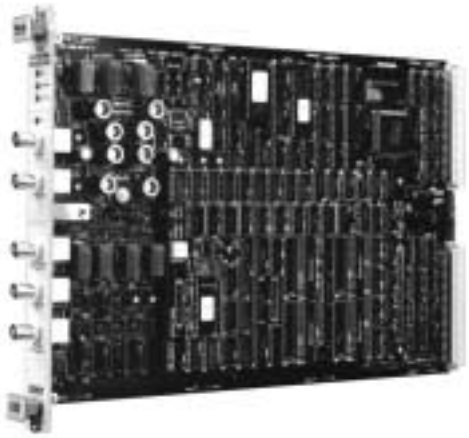
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Racal Instruments
http://www.racalinstruments.com

PRODUCT INFORMATION

Precision PLL Waveform Synthesizer Model 3152A



- **Phase Locks to External Analog Signals: 500 Hz to 10 MHz, 100 mV to 30 Vrms**
- **Sine and Square Waves up to 50 MHz at Amplitudes up to 16 Vpk-pk into 50 Ω**
- **Built-in Functions: Triangle(x), Sine(x), Sinc, Square, Ramp, Pulse, DC, Exponential & Gaussian Pulse**
- **New Linear/Log Sweep Feature Outputs Sine/Square/Triangle to 10 MHz**
- **High-Performance Frequency Synthesis: 7-Digit Resolution and Accuracy to 1 ppm**
- **VXI Replacement for Legacy Pulse and Function Generators**

The Racal Instruments Model 3152A Waveform Synthesizer combines 100 MS/s performance, versatility, and compact size in a single-slot VXIbus format. The 3152A is a field-proven instrument ideal for VXI test stimulus generation and is standard on many military and commercial test platforms.

Multifunctional Performance
The 3152A provides a synergistic combination of a swept function generator, pulse generator, programmable sequencer, and arbitrary waveform synthesizer in one instrument.

In addition, the 3152A integrates a phase lock loop, phase modulation, and a frequency counter into a single-slot module saving valuable space.

New Sweep Mode
Users test frequency response using the 3152A's new sweep mode. The 3152A sweeps sine, square or triangle waveforms from any two frequencies up to 10 MHz. Sweep may be performed either up or down and linearly or logarithmically.

Enhanced Throughput
New high-speed commands, binary download modes, and a faster internal CPU allow the 3152A to run your test sequences faster than ever before.

Tektronix VX4750 Emulation
As an option, the 3152A can accept native commands of the obsolete VX4750 Generator to ease its replacement in legacy test systems.

See the 3152A cross-reference guide on the Racal Instruments website for compatibility information with the VX4750 and other obsolete VXI generators.

7-Digit Frequency Resolution
The 3152A's DDS (Direct Digital Synthesis) frequency synthesizer provides the high signal-noise ratio (70 dB, typical) and low phase-noise and jitter needed for telecommunications test applications.

Phase Locking and Phase Modulation
The 3152A is the first VXIbus module to incorporate external analog Phase Modulation (PM) and Phase Locking to external analog waveforms into a single instrument. The PM feature is useful in real-time phase offset control

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and telecom applications. The phase lock feature automatically locks the 3152A's output to external signals at frequencies up to 10 MHz and voltages up to 30 Vrms. Phase offset is programmable with 0.01º resolution, and the trigger threshold is programmable with 10 mV resolution.

Sequences of up to 4096 Waveforms
Powerful sequencing capability allows the linkage of up to 4096 waveform segments and/or bursts (repeated segments). A segment can be repeated up to 1 million times in burst mode. Sequenced functions run continuously or when initiated by a trigger. The sequencing features permit the creation of complex pulse patterns using minimal amounts of memory.

Built in Frequency Counter
The 3152A's PLL function adds 4-digit frequency read back for any external signal up to 30 Vrms in amplitude and10 MHz in frequency. This makes the 3152A usable for general-purpose frequency counter applications.

100 MegaSamples/Second Sample Rate
A high sample rate of 100 MS/s makes the 3152A an ideal modulation source for troubleshooting new encoding schemes that use increasingly narrow channel widths. The 3152A also can provide high-speed waveforms to simulate signal distortion, power line cycle dropouts, component failures, and power supply transients.

Flexible Triggering Capability
Combining VXIbus trigger lines with the 3152A's sync capability transforms the 3152A into an Arbitrary Trigger Generator. In addition to continuous output, the 3152A can also wait for a trigger to initiate either a single waveform, a burst of waveforms, or a sequence of waveforms. Triggers can also be used to advance a sequence of waveforms one segment at a time. The 3152A can trigger immediately, or delay up to 2 million wave points. Precise trigger level control is provided to ±10 V, with 10 mV accuracy.

Arbitrary Waveform Creation
The Model 3152A, in combination with WaveCAD™ 3.4 software, allows sophisticated waveform generation for many test applications.

VXI*plug&play* Drivers
VXI*plug&play* drivers for Windows 95/98/ME/NT/2000/XP simplify test system design and integration. The 3152A supports both LabWindows/CVI and LabVIEW. These drivers provide precise control of the device. A soft front panel is also included for "hands-on" access to 3152A features.

MODEL 3152A SPECIFICATIONS

AMPLITUDE CHARACTERISTICS

Amplitude
20 mV – 32 Vpk-pk, output open circuit
10 mV – 16 Vpk-pk, into 50 Ω
Resolution
3.5 digits
Accuracy (at 1 kHz and specified output)
±1% of setting
Amplitude Ranges
R1: 10.00 mV-160.0 mV
R2: 160.1 mV-1.600 V
R3: 1.601 V-16.00 V
Accuracy (at 1 kHz)
±1% of setting
DC Offset Range
0 to ± 7.19 V
DC Offset Accuracy
R1: ±(1% Vampl. +1% Vofs. +0.2 mV)
R2: ±(1% Vampl. +1% Vofs. +2 mV)
R3: ±(1% Vampl. +1% Vofs. +20 mV)
Waveform Dynamic Range
Vampl. + Vofs. ≤ max. of selected amplitude range: 12bits
Vampl. + Vofs. > max. of selected amplitude range: <12 bits
(derates as Vofs. is increased)
Low-Pass Filters
20 MHz, 7-pole, Gaussian
25 MHz, 7-pole, elliptic
50 MHz, 7-pole, elliptic
Standby (Output disconnected)
Output On or Off
Output Protection
Short circuit
Glitch Energy
1 nV-s at 16 Vpk-pk

STANDARD WAVEFORMS

(Sine^X, Triangle^X, Square, Pulse, Ramp, Sinc, Gaussian Pulse, Exponential Decay Pulse, Exponential Rise Pulse, DC.)
Frequency Resolution
7 digits
Accuracy
±.01% of setting
Stability
1 ppm

Sine^x Function
(Sine function raised to the xth power)
Frequency Range
100 µHz to 50 MHz
Distortion (4096 points)
< 0.1% below 100 kHz
Harmonics

Frequency	Amplitude	Harmonic Level
<5 MHz	10 Vpk-pk	-48 dBc
<5 MHz	16 Vpk-pk	-40 dBc
<10 MHz	10 Vpk-pk	-40 dBc
<10 MHz	16 Vpk-pk	-35 dBc
<50 MHz	10 Vpk-pk	-28 dBc
<50 MHz	16 Vpk-pk	-20 dBc

Band Flatness
< 1 MHz: 1% (0.09 dB)
< 10 MHz: 5% (0.42 dB)
< 50 MHz: 15% (1.2 dB)
Phase Range
0 - 360º
Exponent Range
Sine^1 - Sine^9

Triangle^X Function
(Triangle function raised to the xth power)
Frequency Range
100 µHz to 1 MHz, usable to 10 MHz
Phase Range
0 - 360º
Exponent Range
1 to 9

Square Wave Function
Frequency Range
100 µHz to 50 MHz
Duty Cycle Range
1% - 99%
Rise/Fall Time
7 ns
Aberration
5%

Pulse and Ramp Functions
Frequency Range
100 µHz to 1 MHz
Delay, Rise Time, High Time, and Fall Time Ranges
0% to 99.9% of period each (independently)
Pulse Rise and Fall Time
(10% to 90% of FS)
7 ns
Aberration
5%

Sinc Function **(Sine(x) x)**
Frequency Range
100 µHz to 1 MHz
Range of Cycles
4 to 100

Gaussian Pulse Function
Frequency Range
100 µHz to 1 MHz
Exponent
1 to 200

Exponential Pulse Function
(Pulses with exponential rise or decay times)
Frequency Range
100 µHz to 1 MHz
Exponent Range
-200 to 200

DC Output Function

Amplitude Range
0% to ±100% of max. amplitude

ARBITRARY WAVEFORMS

(Waveform memory may be "segmented" allowing storage of multiple waveforms.)

Custom Waveform Creation Software
WaveCAD software allows creation of custom waveforms, either freehand, using equations, simulation tools, or using waveforms recorded in the real world.

Waveform Memory
512k points

Vertical Resolution
12 bits (4096 levels)

Number of Memory Segments
1 to 4096

Minimum Segment Size
10 points

SEQUENCED WAVEFORMS

(Waveform segments may be repeated or "looped." Waveform loops may be linked and sequenced.)

Sequencer Step Limits
4096

Segment Loops
0 to 1 Meg

Segment Duration
100 ns minimum, > 1 loop

Fast Sequence Download
100 Steps < 250 ms

SWEEP WAVEFORMS

Sweep Range
100 uHz to 10 MHz

Waveforms
Sine, square, triangle

Spacing
Linear, logarithmic

Direction
Up or down

Step Range
10 to 1000

Sweep Duration
0.01 to 1000 s

SAMPLING CLOCK

Internal Source Range
100 mHz to 100 MHz

External Source Range
Up to 100 MHz

VXIbus Backplane Source
ECLTRG0 up to 66 MHz

Internal Reference
Standard: VXIbus CLK10
Optional: 10 MHz TCXO
1 ppm accuracy

OPERATING MODES

(Normal, Sequenced, Triggered, Triggered Sequence Advance, Delay Triggered, Gated, Burst, Amplitude Modulated)

Normal Mode
Continuous output of a single waveform segment

Sequenced Mode
Continuous output of a sequence of waveform segments

Sweep Mode
Continuous output of a swept waveform

Triggered Mode
One waveform cycle or sequence or Sweep is output

Triggered Sequence Advance Mode
Sequence or sweep is advanced to the next step each time a trigger is received

Delayed Triggered Mode
Delays any trigger by up to 2 million waveform points

Gated Mode
Generator is enabled when an external gate signal is active. The first gated output cycle is synchronous with the active slope of the gate signal. The last output cycle is always completed.

Burst Mode
A segment is repeated up to 1 million times. In *External* Burst Mode, each burst begins with a trigger. In *Internal* Burst Mode, an internal timer is used to repeat the burst at a programmed interval.

Phase Lock Mode
Phase locks a standard or arbitrary waveform to an external signal to 30 Vrms.

Phase Modulation (external)
PM Modulation Rate: 0 to 10 kHz

Amplitude Modulation (internal)
AM Modulation Rate: 10 Hz to 500 Hz
AM Depth: 1% to 200%

TRIGGERING CHARACTERISTICS

Sources
Internal: 1 mHz – 66 kHz timer
External: 10 kΩ, 100 mV to 30 Vrms
Level (Programmable): ±10 V
Resolution: 10 mV
Sensitivity: ± (5% of level + 150 mV)
VXI Backplane: TTLTRG0-7

Maximum Trigger Frequency
Internal Timer: 66 kHz
External: 5 MHz

Minimum External Trigger Pulse Width
20 ns

Trigger slope
Positive or negative

Trigger Delay
0 to 2 Meg points (sample clocks)

System Delay (Trig I/P to Waveform O/P)
Standard Waveforms: 120 ns +2 clock periods ± 1 clock period
Arbitrary Waveforms: 150 ns +2 clock periods ±1 clock period

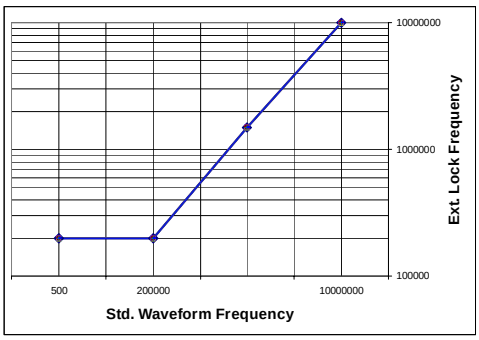
Sync Output
Front Panel: TTL
VXI Backplane: TTLTRG0-7

Sync Sources
Any point, sequence complete, 1/2 clock period

PLL CHARACTERISTICS

Operation
Automatically locks to external signal

PLL Input Characteristics
Same as TRIG IN



External Lock Frequency Range
Standard Waveforms: see curve above
Arbitrary Waveforms: 500 Hz to 100 MHz divided by number of waveform samples

Coarse Phase Offset Range
±180°

Resolution
Standard Waveforms: 0.72°, frequency settings from 500 Hz to 200 kHz; 360° x frequency (in MHz) / 100, freq. settings from 200 kHz to 10 MHz
Arbitrary Waveforms: 360°/ number of waveform samples

Accuracy
5.4 x frequency (in MHz) + resol./2

Fine Phase Offset Control Range
±36° around coarse phase offset setting

Resolution
0.01°

Accuracy
10%, typical

FREQUENCY COUNTER

Operation
Made available to the user in PLL mode only. Frequency reading is valid only when PLL ON LED is lit.

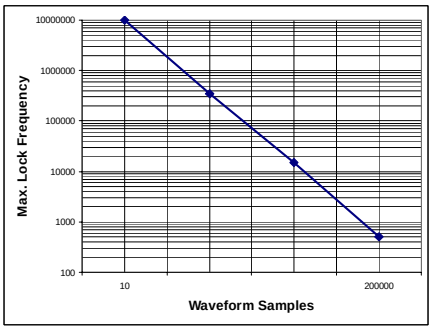
Range
Same as External Lock Frequency Range above

Resolution
4 digits

PM CHARACTERISTICS

Operation
External signal offsets phase. The PM input is operational in PLL mode.

PM Input
Impedance: 100 kΩ, ±5%
Sensitivity: 20 mV, typical
Accuracy: ±30%



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MULTIPLE-MODULE SYNCHRONIZATION

(Multiple modules may be placed in any chassis slots with no cumulative error.)

Phase Accuracy

± (20 ns *f_{out}*360°+P.O.R.)

Phase Offset Resolution (P.O.R.)

360^{o} / (Number of points)

Phase Offset Range

0° to 360°-2880°/n

(Where n is the number of points in the selected memory segment.)

Synchronization Source

ECLTRG0-1

Sample Clock Rate

Up to 66 MS/s

FRONT PANEL I/O

(Accessed with BNC connectors)

Inputs

Trigger/Gate: Z_{in} = 1 kΩ, TTL voltage level

External Sample Clock: TTL voltage level

Phase Modulation Input: 100 kΩ, 30 Vrms

Outputs

Waveform: Z_{out} = 50 Ω

Marker/Sync: Z_{out} = 50 Ω, TTL

VXIbus INTERFACE DATA

(Single-slot, message based, VXIbus 1.4 compliant)

Software

SCPI, IEEE 488.2

Drivers

LabVIEW, LabWINDOWS/CVI, VXI*plug&play*

Shared Waveform Memory

A24/A32 VME block transfer

Backplane Signal Support

TTLTRG0-7: Trigger In, Sync Out

ECLTRG0-1: Sample Clock Source, Module Synchronization

Status Lights

Red: Power-On Self-Test Failure

Yellow: Module accessed on

VXIbus

Green: Output on/off

Cooling (10 °C Rise)

3.7l/s @ 0.55 mmH_20

Peak Current & Power Consumption

	+24	+12	+5	-5.2	-12	-24
I_{pm} (A)	.25	.10	3.0	2.0	.10	.25
I_{dm} (A)	.25	.10	.15	.15	.10	.15

Total Power: 40 Watts

ENVIRONMENTAL

Temperature

Operating: 0° C-55° C

Specification Compliance: 20° to 30° C for specified data, 30 min. warm-up, 50 Ω load

Storage: -40º C to +70º C

Humidity (non-condensing)

11° C-30° C, 95% ±5%

31° C-40° C, 75% ±5%

41° C-50° C, 45% ±5%

Altitude

Operating: 10,000 ft.

Storage: 15,000 ft.

Vibration (non-operating)

2 g at 55 Hz

Shock (non-operating)

30 g, 11 ms, 1/2 sine wave

Weight

3 lb. 8 oz. (1.6 kg)

EMC (Council Directive 89/336/EEC)

EN55011, Group 1, Class A

EN 50082-1, IEC 801-2,3,4

Safety (Low Voltage Directive 73/23/EEC)

EN 61010-1, IEC1010-1, UL3111-1, CSA 22.2 #1010

3152 to 3152A Cross-Reference Guide

Original Configuration		New 3152A Configuration	
Model 3152	**Part Number**	**Model 3152A**	**Part Number**
3152	407510-001	3152A	407808-001
3152 w/256 k	407510-002	3152A w/512 k	407808-003
3152 w/512 k	407510-003	3152A w/512 k	407808-003
3152 w/64 k, 1ppm	407510-011	3152A, 1 ppm	407808-011
3152 w/256 k, 1ppm	407510-012	3152A 2/512 k, 1 ppm	407808-013
3152 2/512 k, 1ppm	407510-013	3152A w/512 k, 1 ppm	407808-013
3152-S-1619	407510-001S1619	3152A	407808-001
3152-S-1619A	407510-013A1619A	3152A w/512 k, 1 ppm	407808-013
3152-S-1755 (Germany STN)	407510-003S1755	3152A 2/512 k	407808-003S1755
VX4750 (Tektronix)		3152A 2/512 k, 1ppm, TEK	407808-213

Note: All old 3152 (407510-xxx) models are obsolete. Use the appropriate 3152A configuration as a direct replacement.

ORDERING INFORMATION

Model	Description	Part Number
3152A/512 k	100 MS/s Waveform Generator, 100 MHz w/512 k RAM	407808-003
3152A/512 k/1 ppm	100 MS/s Waveform Generator, 100 MHZ w/512 k RAM, 1 ppm	407808-013
3152A/TEK	100 MS/s Waveform Generator, 100 MHz w/512 k RAM, Tektronix VX4750 Native Commands	407808-203
3152A/TEK/1 ppm	100 MS/s Waveform Generator, 100 MHz w/512 k RAM, Tektronix VX4750 Native Commands	407808-213

CE The CE Mark indicates that the product has completed and passed rigorous testing in the area of RF Emissions, Immunity to Electromagnetic Disturbances and complies with European electrical safety standards.

The Racal policy is one of continuous development; consequently, the equipment may vary in detail from the description and specification in this publication.

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